

RESTRICTED

INSTRUCTION BOOK

RADIO RECEIVING EQUIPMENT MODEL RAZ-1

FREQUENCY RANGE

15 to 600 Kcs.

RADIO RECEIVER

CRM-46092

PRE-SELECTOR

CRM-50092

RECTIFIER POWER UNIT

CRM-20096

Manufactured for U. S. Navy Department, Bureau of Ships

— By —

RADIOMARINE CORPORATION OF AMERICA

75 Varick Street, New York, N. Y.

JULY 1942

Contract NOs. 94949 (Dated 2, December 1941)

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MODEL RAZ-1

The model RAZ-1 radio receiving equipment comprises the following major units:

- CRM-46092 - Radio Receiver
- CRM-50092 - Pre-Selector
- CRM-20096 - Rectifier Power Supply Unit

The CRM-46092 radio receiver and the CRM-50092 pre-selector cover a continuous frequency range of 15 to 600 K.C., divided into four bands. Two selector switches are used on the radio receiver and a similar switch is employed on the pre-selector to obtain the following frequency ranges:

- Range 1 - 15 to 40 K.C.
- Range 2 - 40 to 100 K.C.
- Range 3 - 100 to 250 K.C.
- Range 4 - 250 to 600 K.C.

Ample overlap between each of the four ranges is provided.

A total of six vacuum tubes are used in the equipment as follows:

CRM-46092 - Receiver

- 1 - 6K7 - R. F. Amplifier
- 1 - 6K7 - Regenerative Detector
- 1 - 6K7 - First Audio Amplifier
- 1 - 6F6 - Second Audio Amplifier

CRM-50092 - Pre-Selector

- 1 - 6SG7 - R. F. Amplifier

CRM-20096 - Rectifier Power Supply Unit

- 1 - 5W4 - Full Wave Rectifier

The power drain from the 110 volt, 50/60 cycle, supply line is approximately 40 watts. For emergency service when A.C. is not available, the receiver and pre-selector may be used without the rectifier unit. In such cases a 6 volt storage battery to deliver 2.3 amperes and a 90 volt "B" battery to deliver 15 m.a. are required.

See page 9 for details of pre-selector.

The "Rectifier Power Unit" for 115 volt, 50/60-cycle power supply is mounted in a separate matching cabinet approximately 11-7/16 inches deep, 9-1/4 inches wide, and 8-1/4 inches high, and is designed so that it may be installed at the right side of the receiver to permit convenient connection of the four leads between the rectifier unit and the receiver proper. The circuit diagram of the rectifier power unit is shown on drawing K-53, included in this book. A type 5W4 rectifier tube is used as a full-wave rectifier in conjunction with a suitable filter and voltage divider network to supply 90 volts and 22 volts to the receiver. A separate filament transformer, mounted in the rectifier unit, furnishes 6.3 volts for the heater circuits of the tubes in the radio receiver. The front panel of the rectifier unit contains an "On-Off" switch and a 6.3 volt Mazda #40 indicator light, the latter operating in parallel to the 6.3 volt filament winding. When the rectifier unit is used, the "On-Off" switch on the receiver panel may be left "On" and the switch on the rectifier unit used to turn the complete equipment on or off. The incoming 115 volt, 50/60 cycle power supply for the rectifier unit should be connected to the terminals provided inside of the cabinet. A pair of one ampere glass fuses are used in series with the 115 volt input to the rectifier unit.

The following controls are provided on the receiver:
Antenna Coupling - Volume - Regeneration - Trimmer - Main
Tuning Control - Range Selector Switches (2) - First and Second
Stage Phone Jacks - On-Off Switch.

The circuit used in the receiver is shown on Diagram T-319M. There are three tuned circuits and four sets of coils. The main tuning condenser is a three gang unit. A small trimmer condenser adjustable from the front panel is also used in the R. F. amplifier grid circuit. The antenna is coupled to the first tuned circuit through a small variable condenser. This circuit is coupled to the R. F. amplifier grid circuit inductively, using fixed coupling between the coils. Volume control is obtained by means of a potentiometer, which applies a bias to the cathode of the R. F. tube. Regeneration control is obtained by means of a second potentiometer which controls the screen voltage of the regenerative detector. Fixed coupling is used between the amplifier plate coils and the detector tickler coils.

Two selector switches are used, one in the upper left section of the panel, which controls the first tuned circuit and R. F grid coils, while the second switch in the upper

right section of the panel controls the amplifier plate and tickler coils. Separate coils are used throughout for each range so that stable operation is obtained without dead spots or other erratic performance which might result from tapped coils.

The regenerative detector is coupled to the first audio stage through a low pass filter, while the first audio stage is resistance coupled to the second stage as shown on T-319N. The plate current of the second audio stage is carried through the telephone receivers and for this reason it is important to use the correct polarity on the telephone cords to prevent demagnetization. With Trimm headphones the phone plug tip should be connected to the red tracer. With W.E. phones the plug tip should be connected to the green tracer.

The "On-Off" switch controls the plus 90, plus 22 and plus 6 volt circuits. A special 15-ohm "drying" resistor is mounted on the under side of the chassis to produce a small amount of heat so that the component units are kept dry and free from corrosion. Care should be taken not to operate the receiver with the tube door removed as the entire design has been made to provide complete enclosure of the chassis, which is desirable under marine atmospheric conditions.

Correct procedure in tuning and adjusting the receiver should be carefully understood by the operator. Each range selector switch should be placed at the proper point for the range desired. Refer to the "Typical Calibration" for the receiver, which is shown on Page 8 of this instruction book. The "On-Off" switch should be turned to the "On" position, allowing about 15 seconds for the tubes to heat up. Also turn on the switch on the rectifier unit, if this unit is used. The antenna coupling should be turned about 90 degrees clockwise and the volume control about three-quarters clockwise.

As a preliminary adjustment the regeneration control should be turned about one-half counterclockwise. The main tuning dial should now be rotated for the desired signal. After the signal is heard, adjust antenna coupling and trimmer condensers for maximum and adjust the volume control for the desired signal intensity. The regeneration control may then be adjusted to improve the selectivity or to produce oscillations for C.W. reception. It is emphasized that the volume control should never be used at its maximum position unless very weak signals are to be received with low static level. Intelligent use of the volume and regeneration controls will not only result in maximum selectivity and freedom from interference, but will also keep the "B" battery drain to a minimum. For very strong signals, the antenna coupling may also be reduced if

desired, although best selectivity is obtained when antenna coupling and trimmer condensers are adjusted to maximum response as this provides accurate lineup of all three tuned circuits. When using ranges one or two for C.W (A-1) reception, adjust for a low beat note. This will provide maximum selectivity.

When the receiver is installed for battery supply, care should be taken to use suitable wire for the 6-volt circuit to prevent excessive drop. For short runs #14 wire should be used, while for longer runs #12 or larger wire is recommended. A 4-conductor shielded cable for "A" or "B" circuits is considered the most satisfactory. The antenna lead to the receiver, which will usually run from the break-in relay in the radio transmitter, should be kept as short as possible and should run not closer than 3" to the other wiring, steel bulkheads, etc. Care should also be taken not to install the antenna lead to the receiver near high voltage radio-frequency circuits, such as the main antenna lead.

The special chromium panel used on the receiver should be kept clean and dry to preserve its original appearance. Under no circumstances should brass polish or other polishes be used on this panel. If the panel becomes soiled it may be wiped carefully with a cloth moistened with carbon tetrachloride (Carbena cleaning fluid). The receiver chassis should not be removed from the cabinet unless repairs or maintenance are required. Once each six months a drop of light oil or vaseline should be placed on the roller stops, which are used on the selector switches. Care should be taken, however, not to get any lubricant on the switch contacts, which are silver plated. The main condenser shaft near the front panel and the shaft extensions for the selector switches near the panel may also be given one drop of oil at each semi-annual inspection. When withdrawing the chassis from the cabinet it should be pulled straight out, taking care not to damage the selector switches, which clear the cabinet by a small amount.

When inserting tubes for the first time, refer to the tube layout on T-319N, which shows the relative position of the tubes. The two tubes nearest the tube door in the front row are 6K7 and also the tube to the left in the rear row is a 6K7. The tube to the right in the rear row is the 6F6.

Tube characteristics: The 6K7 is a triple-grid super control amplifier, (equivalent Navy type 38567K). The heater rating is 6.3 volts and .3 ampere. At 90 volts plate and screen potential the tube has an amplification factor of 400, a plate resistance of .315

megohms and mutual conductance of 1275 (with 3 V grid bias. The 6F6 pentode, which is used as the second audio amplifier, has a 6.3-volt, .7 ampere heater rating, a plate resistance of 80,000 ohms, an amplification factor of 200 and a mutual conductance of 2,500. All tubes use the same Universal 8-prong socket, with a keyway in the center section, so that it is important to place the correct tubes in their respective sockets.

U.S. NAVY RADIO RECEIVER MODEL CRM-46092
(List of Component Parts)

<u>Item No.</u>	<u>Description</u>
1	Range switch Yaxley No. 1325
2	Range switch Yaxley No. 1325
3	Main tuning condenser, Cardwell S-4181, Three 800 MMFD sections.
4	Antenna coupling condenser, Cardwell S-4330, 100 MMFD.
5	Trimmer condenser, Cardwell S-4330, 100 MMFD.
6	Static drain resistor, Erie 1/2 watt, 100,000 ohms.
7	R.F. amplifier cathode condenser, Fast No. Z282, .1 MFD.
8	R.F. amplifier cathode resistor, Erie 1/2 watt, 1500 ohms.
9	Detector grid condenser, Sangamo BE10, .00025 MFD.
10	Detector grid leak, Erie 1/2 Watt, 1 megohm.
11	Drying resistor, Electrad V1678, 15 ohms 5 watt.
12	First audio cathode condenser, Fast No. Z282, .1 MFD.
13	First audio cathode resistor, Erie 1/2 watt, 5,000 ohms.
14	First audio grid leak, Erie 1/2 watt, 500,000 ohms.
15	Second audio coupling condenser, Sangamo B10, .01 MFD.
16	First audio grid leak, Erie 1/2 Watt, 500,000 ohms.
17	Second audio cathode condenser, Fast No. Z283, .5 MFD.
18	Second audio cathode resistor, Erie 1/2 watt, 2,000 ohms.
19	Second audio plate by-pass condenser, Sangamo BE10, .002 MFD.
20	First audio grid filter resistor, Erie 1/2 watt, 250,000 ohms.
21	Detector plate by-pass condenser, Sangamo B-10, .002 MFD.
22	Detector Plate Resistor, Erie 1/2 watt, 100,000 ohms.

<u>Item No.</u>	<u>Description</u>
23	First Audio Grid condenser, Sangamo B-10, .01 MFD.
24	First Audio Grid Filter condenser, Sangamo B-10, .001 MFD.
25	Main plate filter condensers, three 2 MFD Fast No. 2255, connected in parallel.
26	Regeneration Filter condenser, Fast No. 2255, 2 MFD.
27	Regeneration Control, IRC 8503, 75,000 ohms
28	Volume Control, IRC 8503, 75,000 ohms
29	On-Off switch, Yaxley #733, T.P.S.T.
30	First audio phone jack, Carter imp No. 1.
31	Second audio phone jack, Carter imp No. 1.
32	First audio plate resistor, Erie 1/2 watt, 250,000 ohms.
33	Range one input coil, Sickles No. 4761, 130 MH.
34	Range one grid coil, Same as item No. 33.
34a	Loading resistor, Erie 1/2 watt, 1 megohm
35	Range two input coil, Sickles No. 4760, 25 MH.
36	Range two grid coil, Same as item No. 35.
36a	Loading resistor, Erie 1/2 watt, 500,000 ohms.
37	Range three input coil, Sickles No. 5117, 4 MH.
38	Range three grid coil, Same as item No. 37.
39	Range four input coil, Sickles No. 4759, 600 UH.
40	Range four grid coil, Same as item No. 39.
41	Range one R.F. plate coil, Sickles No. 4761, 130 MH.
42	Range one tickler coil, Sickles No. 4760, 25 MH.
43	Range two R.F. plate coil, Sickles No. 4760, 25 MH.
44	Range two tickler coil, Sickles No. 5117, 4 MH.
45	Range three R.F. plate coil, Sickles No. 5117, 4 MH.
46	Range three tickler coil, Sickles No. 4759, 600 UH.
47	Range four R.F. plate coil, Sickles NO. 4759, 600 UH.
48	Range four tickler coil, Sickles No. 5116, 200 UH.
49	Volume control condenser, Fast No. 2255, 2 MFD.

COMPONENT PARTS FOR RECTIFIER POWER SUPPLY UNIT FOR
RADIO RECEIVER - (CRM-20096)

<u>Item No.</u>	<u>Description</u>
1	Voltage divider resistor, 1500 ohms, 5 watt, Continental Carbon, type D5ST2.
2 °	Voltage divider resistor, 5000 ohms, 5 watt, Continental Carbon, type D5ST2.
3	Filter Resistor, 1500 ohms, 5 watt, Same as item 1.
4	Filter condenser, 24 MFD., 350 volt, Dubilier EY-7240, or Sprague W-3630
5	Filter Condenser, Same as item 4.
6	Filter condenser, Same as item 4.

<u>Item No.</u>	<u>Description</u>
7	Indicator light, 6.3 volt bulb, Mazda #40, .15 amp.
8	Filter choke, 30 H, 350 ohms, 90 MA, Kenyon T-153
9	Plate transformer, 125 volts, 200 MA, and 5.3 volts, 3 amperes, Kenyon T-220.
10	Filament transformer, 6.3 volt, 3 ampere, C.T. Kenyon T-351.
11	By-pass condenser, .01 MFD, Sangamo Type BE-10.
12	By-pass condenser, .01 MFD, same as item 11.
13	On-Off switch, S.P.S.T., H&H #20992.
14	Line fuse, 1 amp., 3 AG Littlefuse.
15	Line fuse, 1 amp., 3 AG Littlefuse.

COMPONENT PARTS FOR PRE-SELECTOR UNIT - CRM-50092

1	Safety Gap
2	10 MMFD Silver Mica Fixed Condenser - Sprague 5M-41
3	100,000 ohms, 1/2 watt carbon Resistor - Erie or Inc
4	600 UH R.F. Coil - Sickles No. 4759
5	4 MH R.F. Coil - Sickles No. 5117
6	25 MH R.F. Coil - Sickles No. 4760
7	130 MF R.F. Coil - Sickles No. 4761
8	Tuning Condenser, Cardwell PL-8207
9	Band Switch - Yaxley 1315-L
10	250 ohm minimum bias resistor, 1/2 watt carbon, Erie or IRC
11	Cathode By-pass Condenser, .1 mfd, 200 volts Fast Z-282
12	Volume Control, 10,000 ohm, IRC E-V-11498, with SPST Switch
13	Bypass Condenser, .1 mfd, 200 volts, Fast Z-282
14	Plate Resistor, 10,000 ohms, 1/2 watt carbon, Erie or IRC
15	Plate Choke, 2.5 MH, National R-100
16	Peaking Condenser, 20 MMFD, Erie type K, Silver Mica
17	Output Coupling Condenser .00025, Sangamo BE-10
18	Filter Choke - National R-100

NOTE 1: - For weights and dimensions, refer to the outline drawings for the respective units.

NOTE 2: - Attention is directed to the fact that the CRM-46092 radio receiver is designed for use with "high impedance" telephone receivers. Conventional receivers of this type have a D. C. resistance of approximately 2000 to 3000 ohms. See page 3. If low impedance headphones are to be used, it is necessary to employ an external matching transformer. Such a transformer, when loaded on the secondary with the headphones, should have a primary impedance of 50,000 to 100,000 ohms with the primary winding capable of carrying 10 m.a. D.C.

December 1941
Revised July 1942

Typical Calibration: Radio Receiving Equipment
U. S. Navy Model RAZ-1

<u>Range 1</u>		<u>Range 2</u>		<u>Range 3</u>		<u>Range 4</u>	
<u>K.C.</u>	<u>Dial</u>	<u>K.C.</u>	<u>Dial</u>	<u>K.C.</u>	<u>Dial</u>	<u>K.C.</u>	<u>Dial</u>
15	8	35	9	90	10	225	5
16	18	40	30	100	28	250	24
17	22	45	43	110	43	275	37
18	30	50	55	120	50	300	47
19	38	55	62	130	57	325	55
20	45	60	68	140	63	350	61
22	54	65	73	*143	64	*355	62
24	60	70	77	150	67	*375	65
26	66	75	80	160	71	*394	68
28	70	80	83	170	74	*400	69
30	74	85	86	180	77	*410	70
32	78	90	88	190	80	420	71
34	81	95	90	200	82	*425	72
36	84	100	92	210	84	430	72.5
38	87	105	94	220	86	440	73.5
40	90	110	99	230	88	450	75
				240	90	*454	75.5
				250	92	460	76
				260	94	*468	76.8
				270	97	470	77
						480	78
						*500	80
						600	88
						700	97

* Ship Frequencies. (Commercial)

Calibration of individual receivers may vary slightly from the above data.

RADIOMARINE CORPORATION OF AMERICA

December 1941
Revised July 1942

SPECIAL INSTRUCTIONS

PRE-SELECTOR UNIT- CRM-50092

The primary function of this unit is to reduce to a negligible amount any radiation which may originate in the CRM-46092 receiver. The pre-selector fully satisfies this requirement, and, in addition, provides added gain and selectivity to the receiver performance.

This device consists of a stage of tuned radio frequency amplification designed for insertion between the antenna and the input terminals of the CRM-46092 receiver. It is housed in a compact cabinet arranged to mount beside and match the appearance of the receiver.

The pre-selector uses one type 6SG7 R. F. amplifier pentode tube.

The front panel controls are as follows:

Frequency Range Selector Switch
Main Tuning Control
Volume Control with Pre-Selector Off-On Switch attached.

Power for the pre-selector is taken from the receiver power supply whether this be a rectifier power supply for A.C. operation or battery power. A shielded power cable is provided to connect to the receiver power terminals marked -

minus A-B (Black) plus 6 (White) plus 90 (Red)

The power consumption is as follows:

0.3 amps at 6 volts

Approximately 8 m.a. at 90 volts D.C. (For maximum pre-selector volume setting. Lower drain occurs with reduced volume settings).

Mechanical construction is similar to the CRM-46092 receiver in that component parts are mounted on an inner chassis which is attached to the front panel. Both panel and chassis may be removed from the cabinet by removing the front panel thumbscrews.

Approximate overall dimensions are as follows:

Height - 8-1/2 inches
Width - 7-1/4 inches
Depth - 9-1/4 inches

The circuit is shown schematically on diagram K-143 included in this book. A capacitive input coupling system connects the antenna to the tuned grid circuit of the R. F. amplifier. The four position range switch selects the proper R. F. coil for each band. The switch and coils are identical to those used in the CRM-46092 receiver. The plate circuit is that of a "wide band R. F. amplifier", and is designed to pass all frequencies between 15 K.C. and 600 K.C., and reject all others. The grid and plate circuits are carefully shielded from one another to prevent radiation from reaching the antenna.

To install the pre-selector, temporarily remove top of cabinet and front panel (attached to chassis), taking care that rubber covered power cable pulls freely through the hole in rear of cabinet. This provides access to the four mounting holes in the base of the cabinet. Install cabinet close to left side of receiver so that very short leads may be used between the "output" terminals of the pre-selector and the "Ant." and "Gnd." of the receiver. Insert 6SG7 tube in pre-selector, replace front panel and top cover, taking care to pull out gently on power cable. Connect 3 conductor power cable to plus 90, plus 6 and minus A-B posts on rectifier power unit or receiver unit, as desired. Color code of power cable is, red plus 90, white plus 6, and black minus A-B.

RECOMMENDED OPERATING PROCEDURE FOR THE PRE-SELECTOR UNIT - CRM-50092

Place range selector switch so that it corresponds to the same position used on the receiver unit proper. Range 1 is 15 - 40, Range 2 is 40 - 100, Range 3 is 100 - 250, and Range 3 is 250 - 600 K.C.

Turn on pre-selector with control marked "R. F. Gain". This control has a switch attached to it so that when the pointer is placed in the "Off" position, the heater circuit of the 6SG7 is opened. When the pre-selector is used with the rectifier power unit, it is unnecessary to turn the R. F. Gain control to the "Off" position to shut down the pre-selector, since turning off the rectifier power unit switch will accomplish the same result. However, with battery power supply, if used, it is necessary to turn the R. F. Gain control on the pre-selector to the "Off" position when the pre-selector is not in use.

To tune in a signal, first adjust the R. F. Gain control on the pre-selector to maximum and set the Tuning Dial approximately to the position for the desired frequency. Refer to table on page 8, then tune in as accurately as possible the desired signal with the tuning control and the various trimmer controls on the CRM-46092 receiver. After this has been done, make a further adjustment of the tuning control on the pre-selector for correct adjustment to resonance.

It will be observed that, with the combination of the pre-selector and the radio receiver itself, the user has in effect two R. F. Gain controls (one on each unit). Operating experience will disclose the best relative setting of these two controls for optimum signal to noise ratio. With strong signals, it is always desirable to sufficiently reduce the R. F. Gain setting on the pre-selector so that the tubes in the receiver proper are not overloaded.

It will be observed that the use of the pre-selector not only reduces undesirable radiation to a negligible degree, but also appreciably increases the gain and selectivity of the complete combination of units.

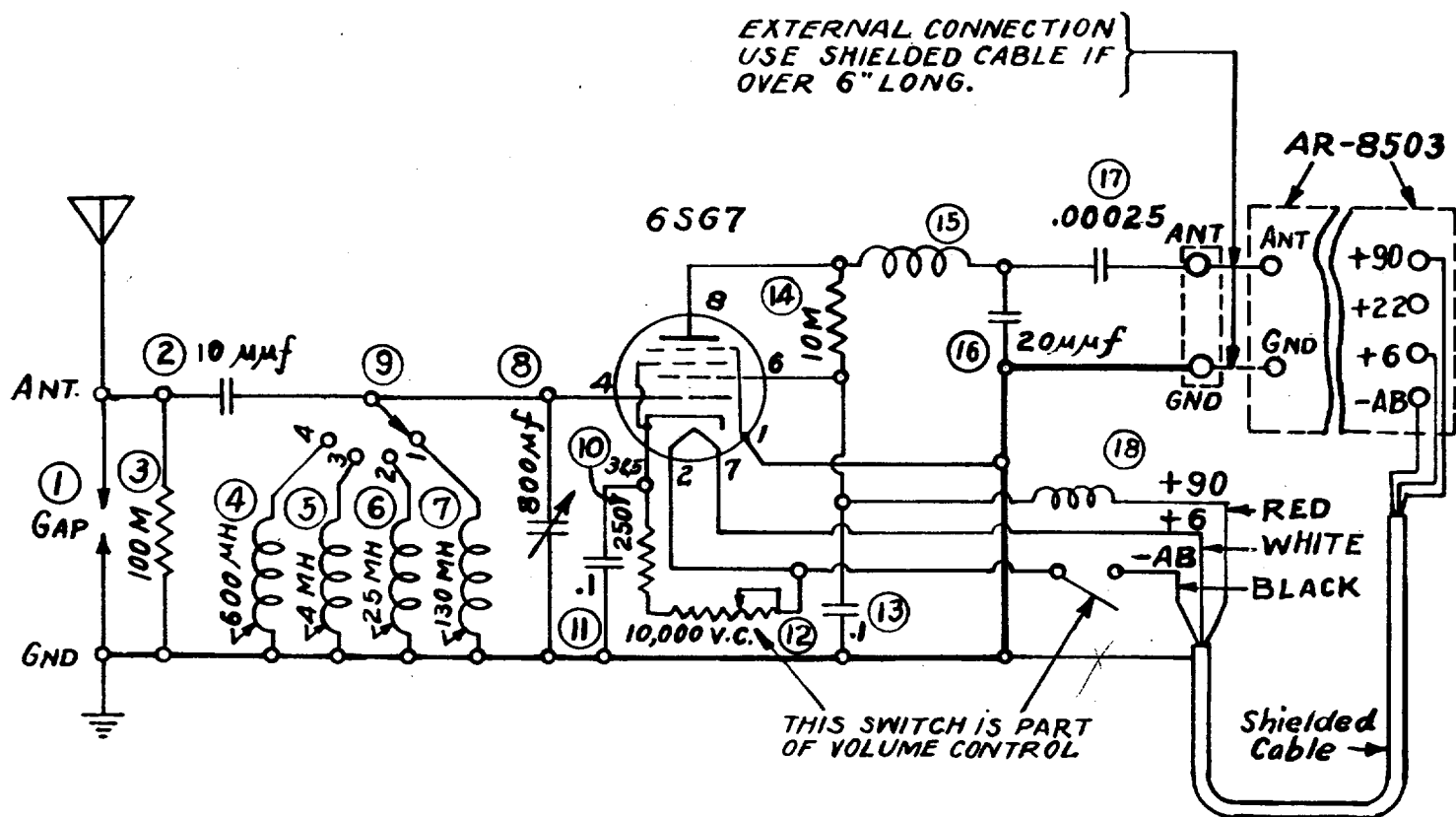
The characteristics of the 6SG7 tube used in the pre-selector are as follows:

Heater rating 6.3 volts, .3 ampere. At 100 volts plate and screen potential, the tube has a transconductance of 4100 with one volt grid bias, and a plate resistance of approximately .25 megohms.

ENCLOSURES:

1. - T-319N- Schematic and External Connections of Receiver
2. - K-143 - Schematic of Pre-Selector Unit
3. - K-53 - Schematic of Rectifier Power Unit
4. - KS-35 - Outline of Pre-Selector Unit
5. - KS-37 - Outline of Rectifier Power Unit
6. - K-40 - Outline of Receiver Unit
7. - Photograph 41220

December 1941
Revised July 1942



RANGE	K.C.
1	15 - 40
2	40 - 100
3	100 - 250
4	250 - 600

SCHEMATIC

TYPE CRM-50092
PRE-SELECTOR UNIT
A UNIT OF MODEL RAZ-I RADIO EQUIPMENT

RADIOMARINE CORP. OF AMERICA

ENGINEERING DEPT.

F.E.S.
S.S.

K-143

RMCA TYPE AR-8503-P

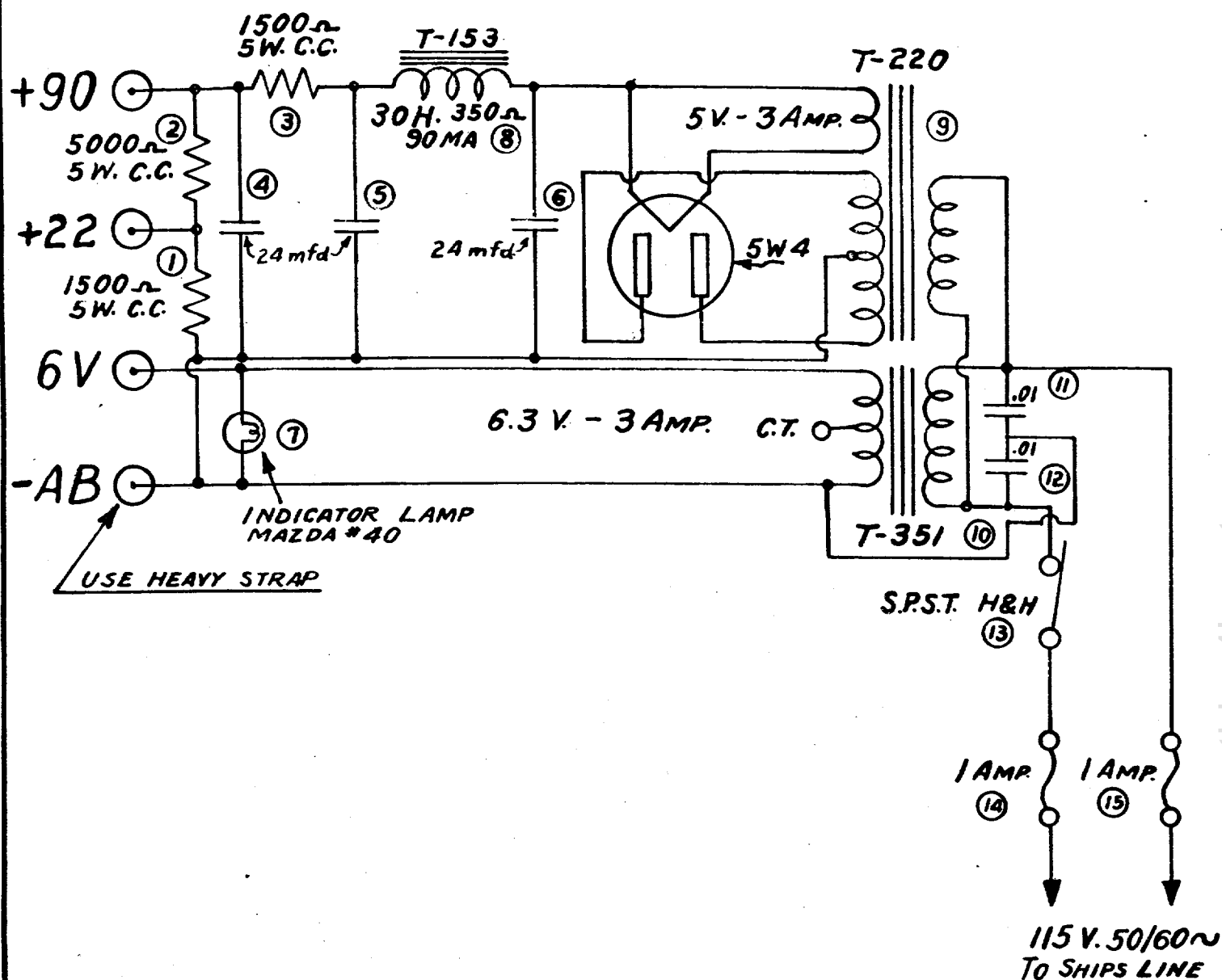
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466

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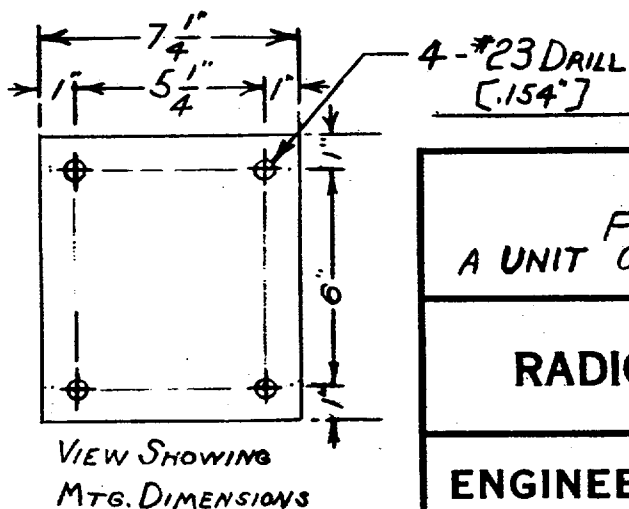
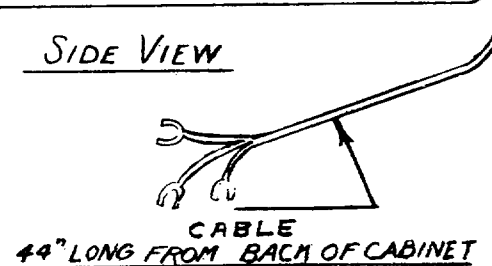
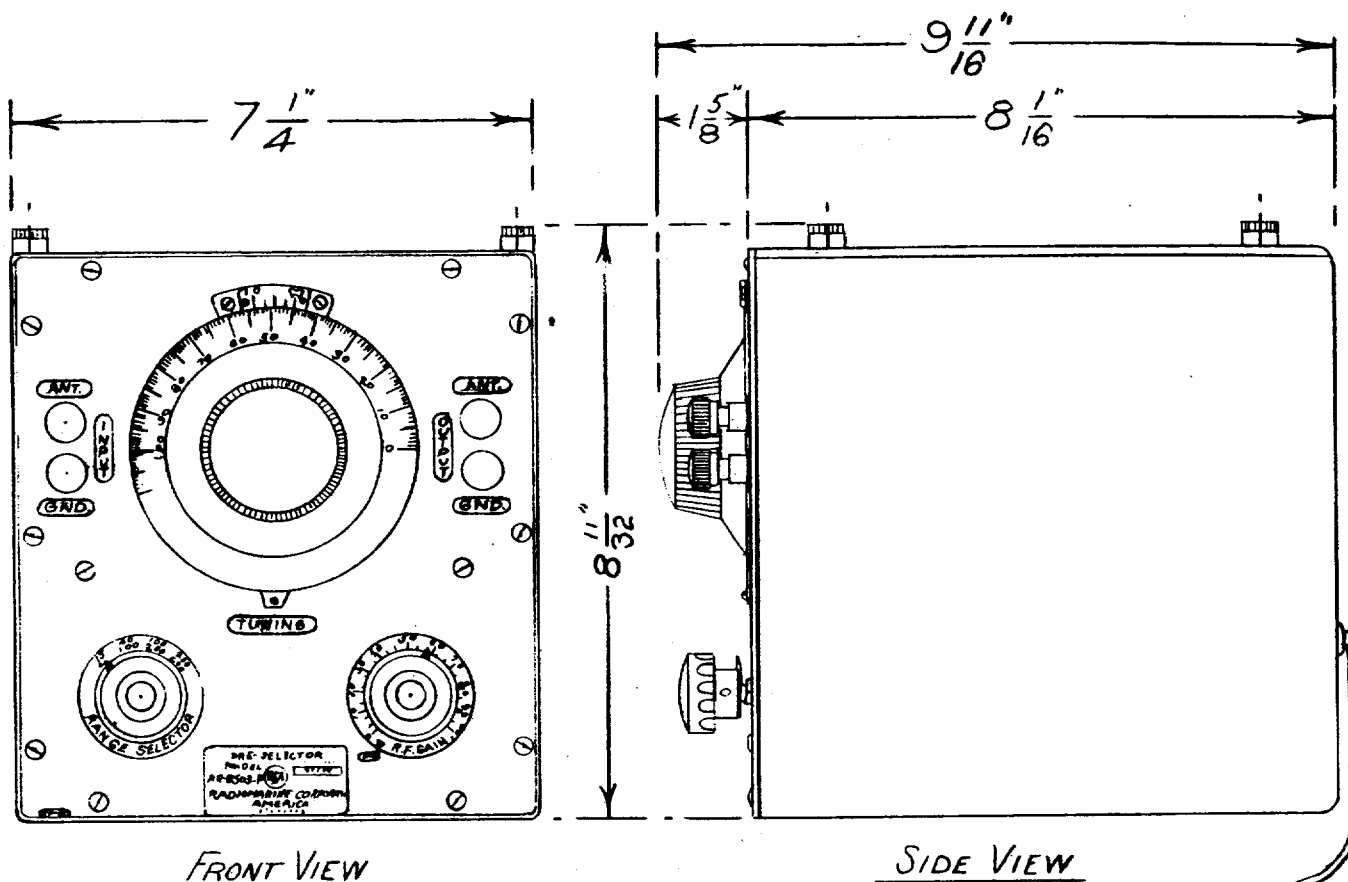
Date 9-12-41

REVISED 1-6-42 S.S.
REVISED 12-2-41 A.R.
REVISED 11-19-41 S.S.



SCHEMATIC

TYPE CRM-20096
RECTIFIER POWER UNIT
A UNIT OF MODEL RAZ-1 RADIO EQUIPMENT



OUTLINE

TYPE CRM-50092
PRE-SELECTOR UNIT
A UNIT OF MODEL RAZ-1 RADIO EQUIPMENT

RADIOMARINE CORP. OF AMERICA

ENGINEERING DEPT.

F. MERMER

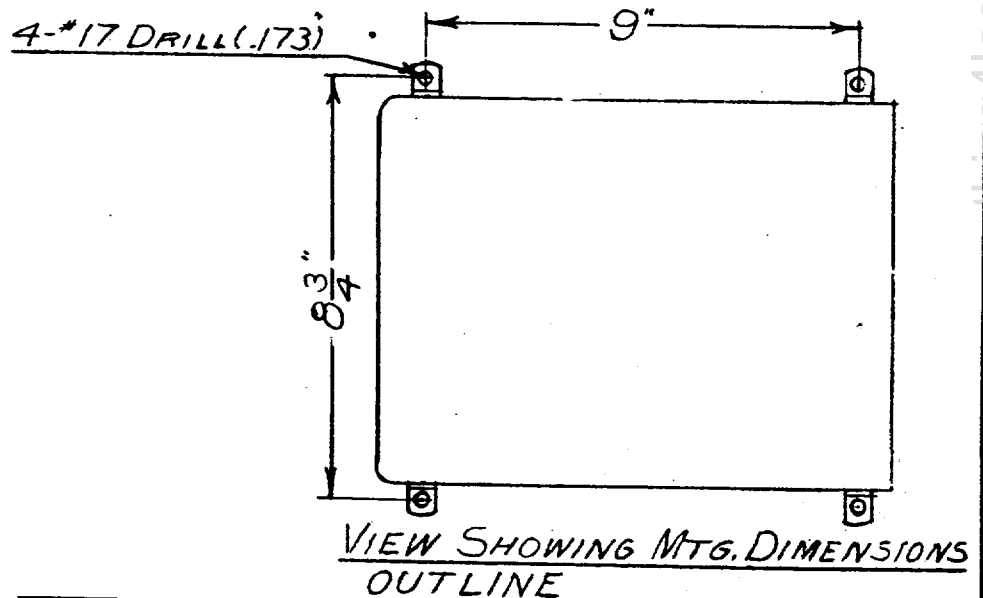
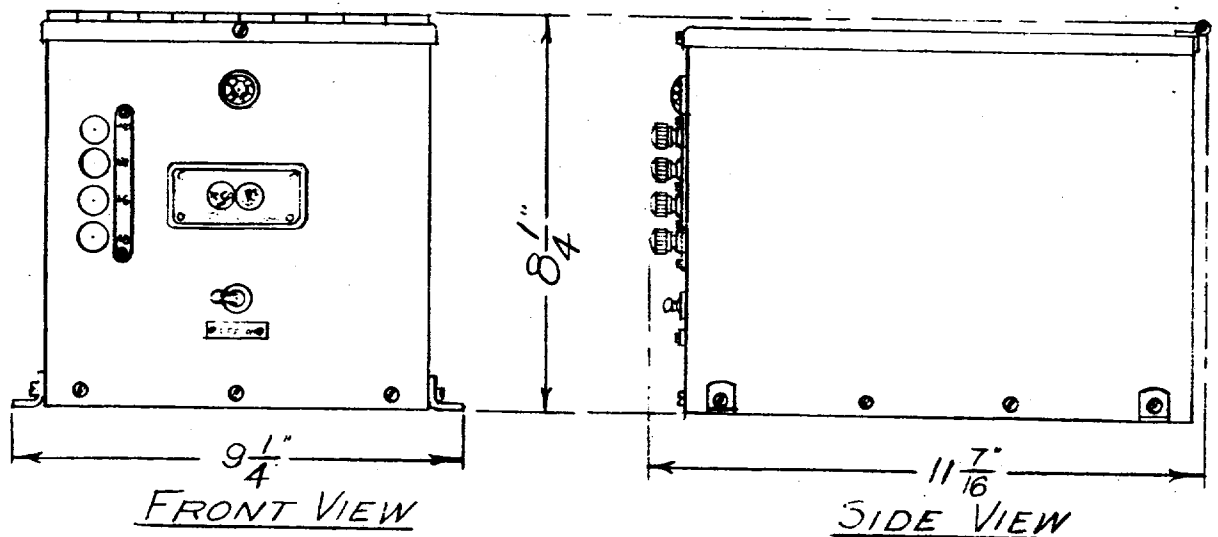
NEW YORK

Sub. 0

KS-35

Date 11-28-41

WEIGHT - 10 LBS.
RMCA TYPE AR-8503-P



TYPE CRM-20096
RECTIFIER POWER UNIT
A UNIT OF MODEL RAZ-1 RADIO EQUIPMENT

RADIOMARINE CORP. OF AMERICA

ENGINEERING DEPT.

M.F. RICCIO

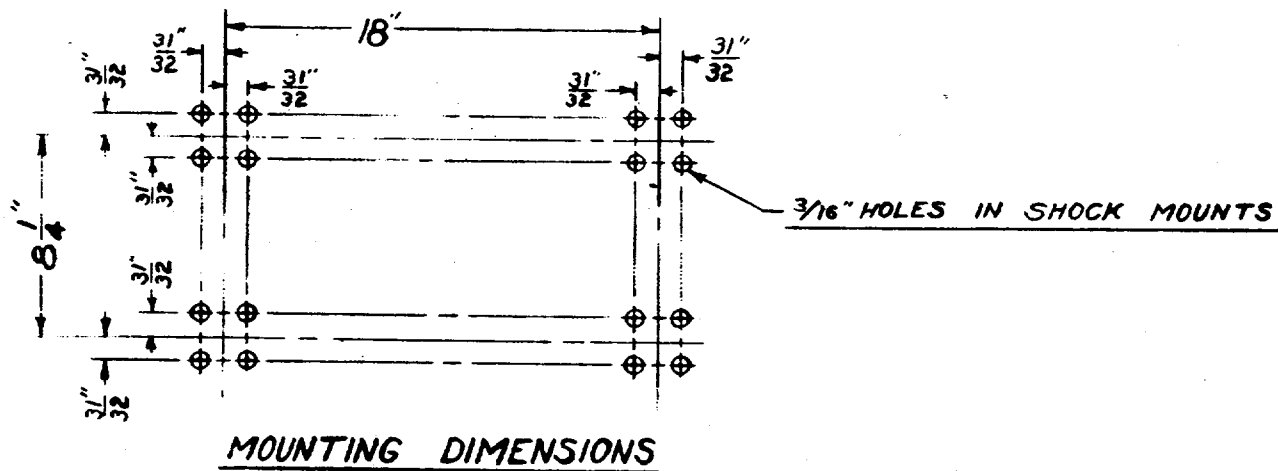
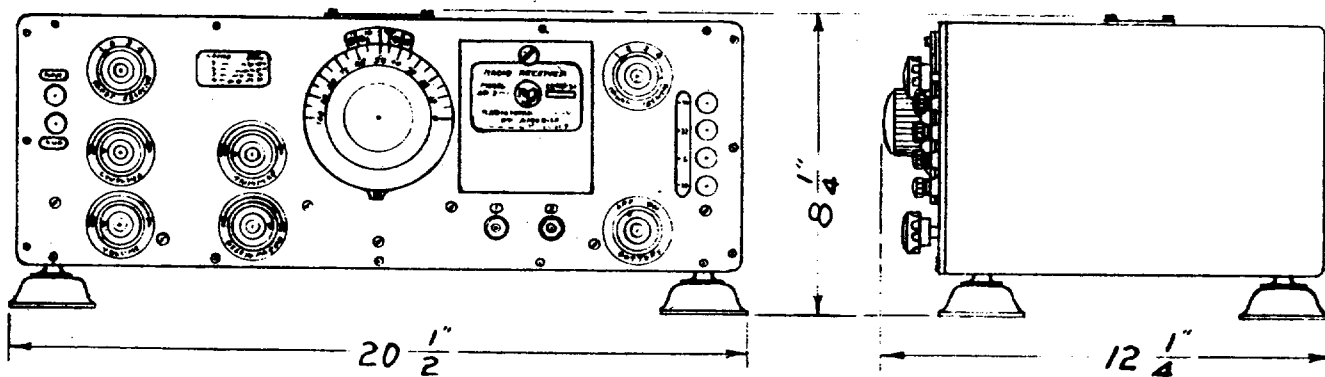
WEIGHT-21 LBS.
RMCA TYPE-RM-6

NEW YORK *AJY*

Sub.0

KS-37

Date 12/3/41



OUTLINE

TYPE CRM-46092
RADIO RECEIVER
A UNIT OF RAZ-1 RADIO EQUIPMENT

RADIOMARINE CORP. OF AMERICA

ENGINEERING DEPT.

M. E. RICCIO

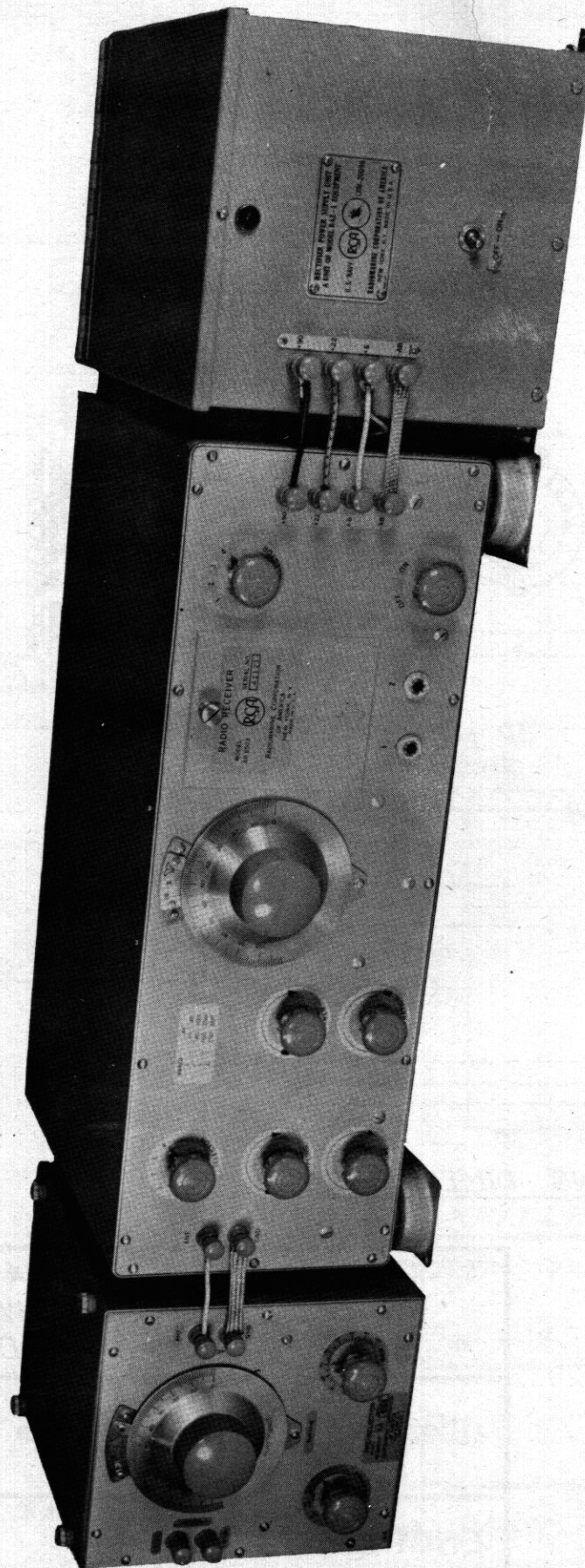
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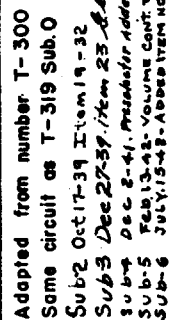
K-40

Date 10-23-39

WEIGHT - 29 LBS.
RMCA TYPE AR-8503



MODEL RAZ-1 RADIO RECEIVING EQUIPMENT



C. B. Co., No. 372 N. 1st St. - 11-24

Serial Numbers 3615 and higher

RADIOMARINE CORP. OF AMERICA

T-319 N

Date 4-26-37